

ADVENTIVE LADY BEETLES (COLEOPTERA: COCCINELLIDAE) IN EASTERN NOVA SCOTIA, CANADA¹

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ABSTRACT: Specimens in three small insect collections document the arrival of four species of adventive lady beetles in Nova Scotia. All four have experienced dramatic range expansions in eastern North America in the past 25 years. *Coccinella septempunctata* arrived by 1984 and by the 1990's was the most common coccinellid in disturbed habitats on Cape Breton Island, NS. The more recent arrivals in Nova Scotia of *Propylea quatuordecimpunctata* (1990), *Harmonia axyridis* (1995) and *Hippodamia variegata* (1996) are reported.

Several species of lady beetles have become established in North America after either accidental or intentional introductions in the past 25 years (Gordon 1985; Gordon and Vandenberg 1991). Populations of some of these introduced species have burgeoned to the extent they have the potential to change dramatically populations of both native and other introduced lady beetles (e.g. Tedders and Schaefer 1994; Wheeler and Hoebeke 1995). Coccinellids deserve attention so that we can document which introduced species become established, the speed of range expansion and major changes in populations.

Recently, Hoebeke and Wheeler (1996) recorded the range expansion of adventive lady beetles in the Maritime provinces of Canada through the summer of 1995. Here I provide updated information from eastern Nova Scotia on three of the four species they reported, *Propylea quatuordecimpunctata*, *Hippodamia variegata* and *Harmonia axyridis*, and information on a species established earlier, *Coccinella septempunctata*.

METHODS

All specimens of Coccinellidae in the small insect collections at the University College of Cape Breton, Sydney, Nova Scotia (UCCB), St. Francis Xavier University, Antigonish, Nova Scotia (STFXU), and the Nova Scotia Department of Natural Resources, Belmont, Nova Scotia (NSDNR) were examined. Identifications were based on Gordon (1985), Gordon and Vandenberg (1991), and comparison with specimens in the University of Guelph Collection, Guelph, Ontario. Representative specimens will be deposited in the Canadian National Collection, Ottawa, Ontario and/or the Nova Scotia Museum of Natural History, Halifax, Nova Scotia.

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RESULTS

Coccinella septempunctata L.: Since 1973 this species has spread over most of the continental United States and southern Canada (Gordon and Vandenberg 1991). Schaefer et al. (1987) reported it in Nova Scotia in 1985. Collections from mainland Nova Scotia in 1984 and Cape Breton Island in 1985 demonstrate that the species was widespread in the province by 1985.

Additional Locality Records:

Cumberland County, Chignecto, 5 June 1984, E. Georgeson, NSDNR; Cape Breton County, Sydney, 26 August 1985, S. Tynski, UCCB; Cape Breton County, Sydney, 16 May 1986, S. Tynski, UCCB

Since 1990, students at the University College of Cape Breton have collected 171 specimens in the subfamily Coccinellinae. Collections are largely from disturbed or anthropogenic habitats in the Sydney-Glace Bay area of Cape Breton Island. About half of these specimens are *Coccinella septempunctata* (86 or 50%), while native species are the next four most frequently collected: *Adalia bipunctata* (24, 14%), *C. trifasciata* (19, 11%), *Anatis mali* (10, 6%) and *Psyllobora vigintiduopunctata* (9, 5%).

Propylea quatuordecimpunctata (L): This species was established in Quebec by 1968, had spread to Maine by 1988 and since then to much of the northeastern United States (Day et al. 1994). There is a strong probability that an independent establishment occurred in lower New York State in the mid-late 1980's (Yanega 1996). Hoebeke and Wheeler (1996) provide the first report for Nova Scotia and record collections from Cape Breton Island in 1995. Collections in the summer of 1996 from Cape Breton and Antigonish Counties indicate that it is now established in eastern Nova Scotia.

Additional Locality Records:

Cape Breton County, Georges River, 8 June 1996, DB McCorquodale, UCCB; Cape Breton County, Sydney, UCCB Campus, 4 September 1996, S. Berrigan, UCCB; Cape Breton County, Sydney, 5 September 1996, T. Rideout, UCCB; Antigonish County, Pomquet, 05 June 1996, R. Lauff, STFXU; Antigonish County, Pomquet, 22 July 1996, R. Lauff, STFXU; Antigonish County, Pomquet, 21 August 1996, R. Lauff, STFXU; Antigonish County, Antigonish, 15 July 1996, R. Lauff, STFXU

Propylea quatuordecimpunctata was established in Nova Scotia for several years prior to the first collections reported by Hoebeke and Wheeler (1996). The Nova Scotia Department of Natural Resources collection has 35 specimens collected between 1990 and 1995, mostly from Colchester County, but also from Pictou and Halifax Counties. The earliest collections are from Debert, Colchester County in 1990. Nine more were collected in Debert in 1991. The first collections from Pictou County were in 1994 and in Halifax County in 1995.

Additional Locality Records:

Colchester County, Debert, 13 June 1990, E. Georgeson, NSDNR; Colchester County, Debert, 16 June 1990, T.D. Smith, NSDNR; Colchester County, Debert, 19 June 1990, E. Georgeson, NSDNR; Pictou County, Lyons Brook, 4 July 1994, E. Georgeson, NSDNR; Halifax County, Peggy's Cove, 15 August 1995, J. Ogden, NSDNR

Harmonia axyridis (Pallas): Many attempts to introduce this species in North America, including Nova Scotia, occurred between 1916 and 1983 (Gordon 1985; Hoebeke and Wheeler 1996). The first established population was recorded in Louisiana in 1988 (Chapin and Brou 1991). Since then there has been an explosive range expansion and population explosion in northeastern North America (see Kidd et al. 1995), with the first records for Canada in 1994 (Coderre et al. 1995; Marshall 1995). This range expansion has continued into the Maritimes with Hoebeke and Wheeler (1996) reporting it from three sites, including two in Nova Scotia (Lunenburg and Digby Counties). They did not record it from Cape Breton Island, where it has since been collected during the summers of 1995 and 1996.

Additional Locality Records:

Cape Breton County, Sydney, UCCB Campus, 19 September 1995, K.J. Aucoin, UCCB; Cape Breton County, Sydney, 15 July 1996, A.A. Risk, UCCB

Hippodamia variegata (Goeze): This species first became established at Montreal, Quebec before 1984 (Gordon 1987). By 1992 it was widely distributed from northern New Jersey through New York, Connecticut and Vermont to Quebec (Wheeler 1993). The continuing range expansion to southern New Brunswick in 1993 and to Prince Edward Island and Colchester County, Nova Scotia in 1995 was documented by Hoebeke and Wheeler (1996). One year later, the spread has continued another few hundred kilometres to Antigonish County and Cape Breton County.

Specimens:

Antigonish County, Antigonish, 10 May 1996, B. Jones, STFXU;
Cape Breton County, Sydney, September 1996, J. Meagher, UCCB

The coccinellid fauna of Nova Scotia has changed dramatically in the past 15 years with the addition of four adventive species. The addition of these species is similar to what has occurred over much of northeastern North America (Gordon and Vandenberg 1991).

It is interesting to compare the rate of range expansion for the four species, from their initial establishment in North America until they reached Cape Breton Island (Table 1). Cape Breton is at the northeastern limit of possible range expansion on continental North America. Further expansion requires a major water crossing to Newfoundland. I have collated the information based on the first established population in North America, as reported in Gordon

Table 1: Average range expansion per year for four species of adventive coccinellids now established on Cape Breton Island, Nova Scotia. First established populations are from Gordon and Vandenberg (1991). The distance to Sydney, NS was measured from "The International Atlas" (McNally 1979).

Species	First established population	First Sydney, NS record	Approximate Distance (km)	Average range expansion per year (km)
<i>Coccinella septempunctata</i>	Bergen County, NJ	1985	1300	108
<i>Propylea quatuordecimpunctata</i>	Quebec City, PQ 1968	1995	850	31
<i>Harmonia axyridis</i>	Abita Springs, LA 1988	1995	3100	442
<i>Hippodamia variegata</i>	Montreal, PQ <1984	1996	1050	80

and Vandenberg (1991) and the first record for Sydney, Cape Breton Island. Linear distance was based on a straight line measurement in "The International Atlas" (McNally 1979).

Rapid range expansion, with a minimum of 30 km/year and maximum of more than 400km/year, is clear for all four species. The rates of range expansion give a good picture of how quickly these species have colonized North America. It is possible these overestimate 'real' rates of range expansion. There have been many releases and attempts to introduce these species in many locations in eastern North America (e.g. Chapin and Brou 1991; Wheeler 1993) and some releases or accidental introductions (e.g. Yanega 1996) closer to Nova Scotia than the first established population, may have been successful. However, the rates are still useful because they emphasize the explosive potential for range expansion of introduced species in North America.

Beyond impressive rates of range expansion, the newly established species will have an effect on the existing assemblage of coccinellids. Within five years of establishment on Cape Breton Island, *Coccinella septempunctata* became the most common species in anthropogenic habitats, as documented by the collections of UCCB students. Now, there are three more adventive species in Cape Breton. It remains to be seen whether one or more of these will displace *C. septempunctata* as the common coccinellid of disturbed habitats. There is also the potential for these adventive species to reduce populations of

native species. Wheeler and Hoebeke (1995) have documented dramatic declines in the populations of the native *C. novemnotata* in eastern North America. Attention should be focused on the influence of these new adventives on the common native species such as *Adalia bipunctata* and *C. trifasciata* in the next few years.

This note documents useful additions to our knowledge on range expansion and establishment of adventive coccinellids based on specimens in small regional insect collections. This type of collection should play a primary role in documenting population changes of these species in the next 15 years.

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SCIENTIFIC NOTE

RECENT INTERCEPTION OF LIVE KHAPRA BEETLE, *TROGODERMA GRANARIUM* (COLEOPTERA: DERMESTIDAE), AT THE PORT OF BALTIMORE, MARYLAND¹

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The khapra beetle, *Trogoderma granarium* Everts, is a quarantined insect pest under United States Department of Agriculture (USDA) regulations. Each day, USDA Animal and Plant Health Inspection Service - Plant Protection Quarantine officers (USDA-APHIS-PPQ) examine a multitude of commodities entering the United States from all over the world looking for numerous foreign insect / plant / animal pests in order to ensure that none are present prior to entering the United States. Inspections are made of both commercial and personal freight arriving daily at ports of entry in vehicle, rail, airline, and ocean liner luggage/baggage. The khapra beetle is one of the major concerns for USDA-APHIS-PPQ officers when examining these imported goods. It is a serious pest of food items including stored cereal grains, dried fruits and other plant and animal materials, and does not occur in North America. Khapra beetles can survive long periods without food and make a habit of hiding in cracks and crevices in the warehouse making them hard to detect (Anonymous, 1983).

In June 1996, a shipment of Basmati rice from Pakistan was off loaded at the Dundalk Marine Terminal, Port of Baltimore, Maryland, U.S.A. Investigators from the U.S. Food and Drug Administration (FDA) collected a surveillance sample to check for compliance under the adulterated food section of the Federal Food, Drug, and Cosmetic Act. The shipment consisted of 550 nylon weave bags, each containing eight - 11 pound cloth bags (sewn closed) of hulled, white grain rice. Examination of the rice at the FDA District Laboratory revealed the presence of live and dead maize weevil adults, *Sitophilus zeamais* Motschulsky (Curculionidae); sawtoothed grain beetle adults, larvae, and pupae, *Oryzaephilus surinamensis* (Linnaeus) (Cucujidae); red flour beetle adults and pupae, *Tribolium castaneum* (Herbst) (Tenebrionidae); and *Trogoderma* sp. dermestid adults and larvae. The *Trogoderma* larvae were initially identified as *T. granarium* Everts (khapra beetle) by the authors using Kingsolver's (1991) key to dermestid beetles. As a professional courtesy, FDA immediately contacted the local USDA-APHIS-PPQ entomologist at the Baltimore Port Office and the specimens were hand delivered for positive confirmation.

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